(12) UK Patent Application (19) GB (11) 2 274 723 (13) A

(43) Date of A Publication 03.08.1994

(21) Application No 9326285.5

(22) Date of Filing 23.12.1993

(30) Priority Data
(31) 9225514 (32) 24.12.1992 (33) KR

(51) INT CL[5]
G02F 1/1339

(52) UK CL (Edition M)
G2F FCD F23E F25F
G5C CA342 CHG

(56) Documents Cited
EP 0556855 A1 EP 0528603 A1 US 4458987 A

(58) Field of Search
UK CL (Edition M) G2F FCD , G5C CHD CHE CHG
INT CL[5] G02F 1/1339 1/1345
Online databases:WPI,CLAIMS

(71) Applicant(s)
Goldstar Co., Ltd

(Incorporated in the Republic of Korea)

20 Yoido-Dong, Youngdungpo-Gu, Seoul, Republic of Korea

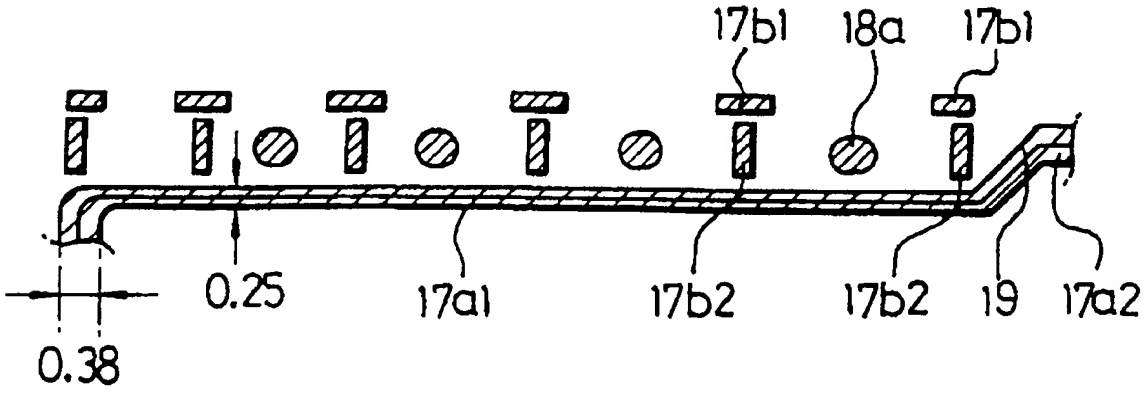
(72) Inventor(s)
Jin Young Kim

(74) Agent and/or Address for Service
Marks & Clerk
57-60 Lincoln's Inn Fields, LONDON, WC2A 3LS, United Kingdom

(54) Liquid crystal display

(57) The upper and lower substrates of a liquid crystal display are secured together by a resin seal 17a1 the width of which differs at different parts of the seal. Dummy resin seals 17b1, 17b2 are provided outside of perimeter of the resin seal and adjacent narrower portions of the seal. Conductors 18a are located between the dummy resin seals. The conductors electrically interconnect the upper and lower substrates.

FIG. 6A



GB 2 274 723 A

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

This print takes account of replacement documents submitted after the date of filing to enable the application to comply with the formal requirements of the Patents Rules 1990.

FIG. 1

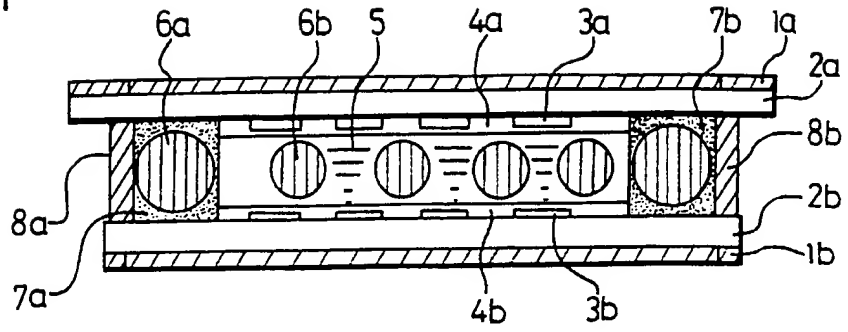


FIG. 2A

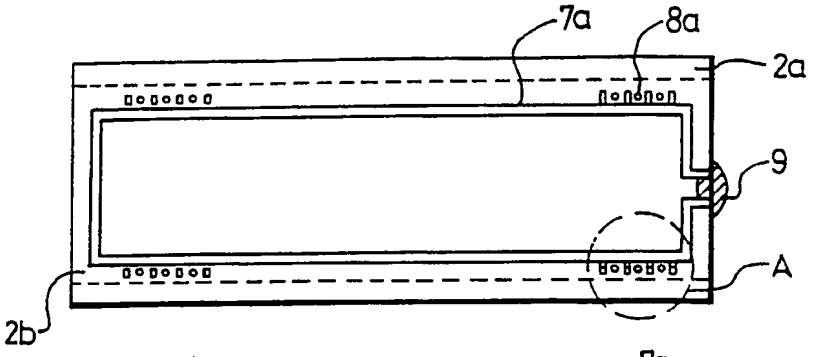


FIG. 2B

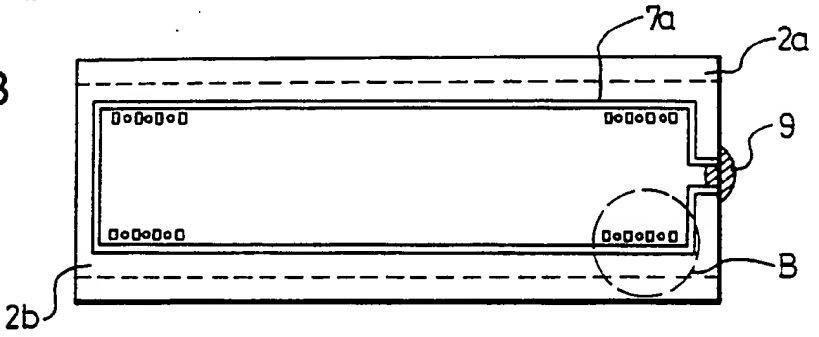


FIG. 3A

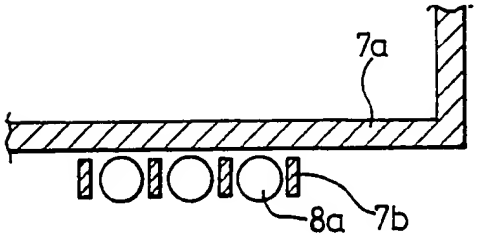


FIG. 3B

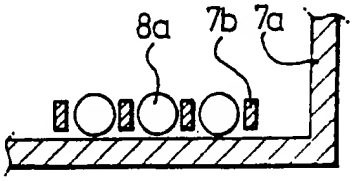


FIG. 4

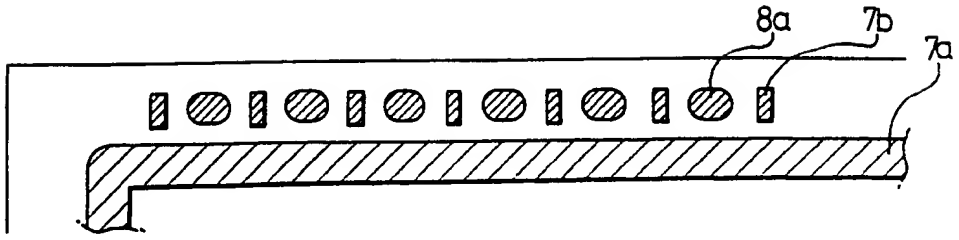


FIG. 5A

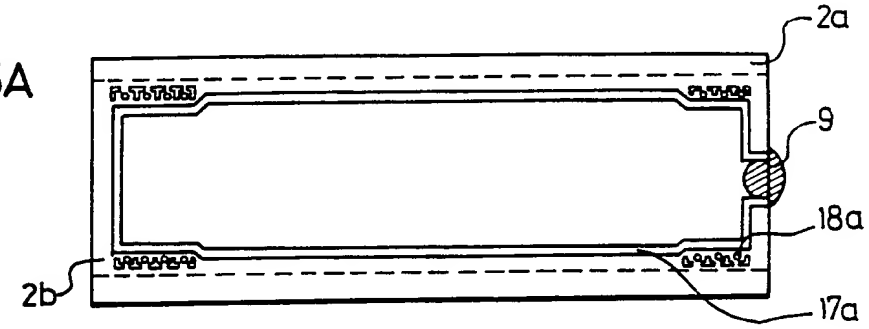


FIG. 5B

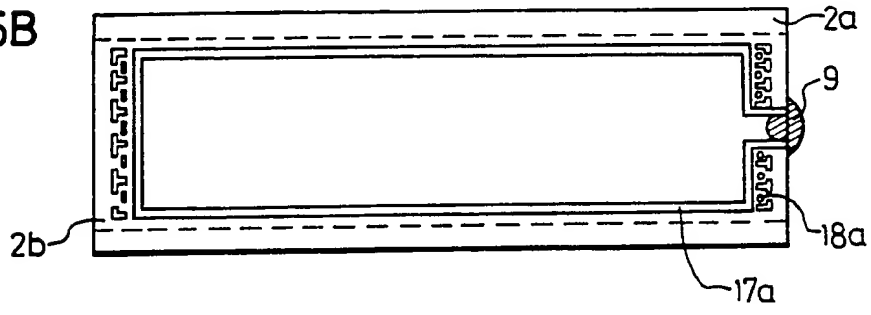


FIG. 6A

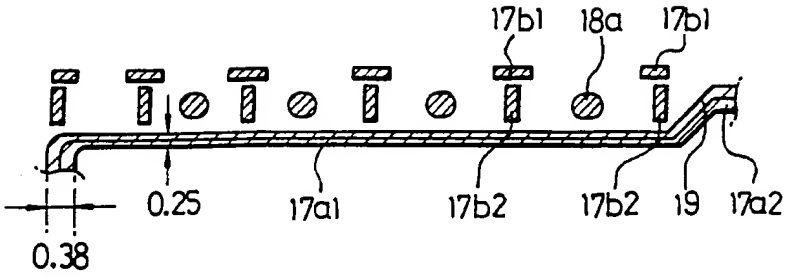


FIG. 6B

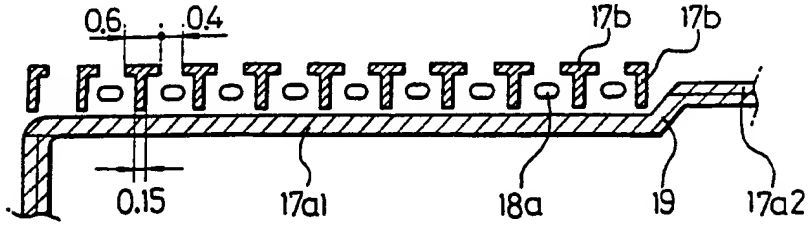


FIG. 6C

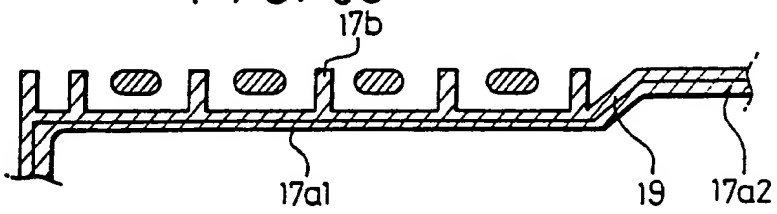
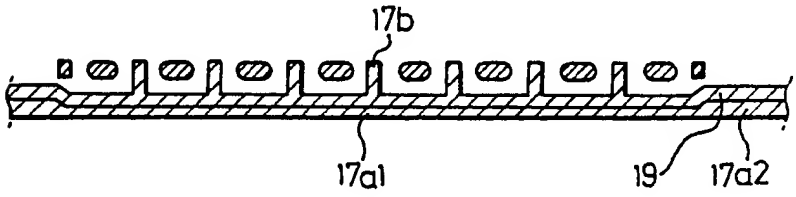


FIG. 6D



LIQUID CRYSTAL DISPLAY AND THE MANUFACTURING METHOD THEREOF

BACKGROUND OF THE INVENTION

1. Technical Field

This invention relates to a liquid crystal display, and more particularly to a liquid crystal display and the manufacturing method thereof, which has a good performance because the uniformity of the cell gap is high even though it is not processed by separate equipment duling manufacturing.

2. Prior Art

Generally, a liquid crystal display (LCD) is an element for displaying desired characters, numerals, or shapes through the change of the optical characteristic thereof by changing the physical characteristics such as the dielectric anisotropy and the refraction anisortropy of the liquid crystal by means of the change of the electric field, which is recently in the spotlight because the power consumption of it is small compared to other display elements and its weight can be reduced.

The general liquid crystal display as described above includes an upper polarizing plate 1a and a lower polarizing plate 1b having a polarizing axis corresponding to the orientation direction of the liquid crystal molecules as shown in FIG. 1. To the lower surface of the upper polarizing plate 1a and to the upper surface of the lower polarizing plate 1b are fixedly attached respectively an upper substrate 2a and a lower substrate 2b of light transmitting glass material. Respectively to the lower surface of the upper substrate 2a and the upper surface of the lower substrate 2b is applied an oxide (S_iO_2) film

layer, the thickness of which is about 200~300Å, and upper electrodes 3a and lower electrodes 3b which are formed as transparent conductive films of Indium Tin Oxide (ITO) respectively are fixedly attached thereto. To the upper electrodes 3a and to the lower electrodes 3b are fixedly attached an upper orientation controlling film 4a and a lower orientation controlling film 4b which are transparent insulating.

Further, to the peripheral surface of the upper orientation controlling film 4a and to the lower orientation controlling film 4b are attached sealing resin parts 7a, 7b, which seal the liquid crystal and include spacers 6a, 6b for maintaining the space between the upper and the lower substrates 2a, 2b in a predetermined range (several to several tens of μm) to prevent the leakage of the liquid crystal. To the outer surface of the sealing resin parts 7a, 7b are fixedly attached conductors 8a, 8b for interconnecting the upper and the lower electrodes 3a, 3b.

The manufacturing process of the conventional LCD constructed as above will be described hereinafter. First, after the upper and the lower substrates 2a, 2b of light transmitting glass material are washed and dried, photoresist is coated thereon, and then it is exposed to light through a chrome mask having a predetermined pattern, so that the upper and the lower electrodes 3a, 3b are formed thereon, and then it is washed and dried.

Further, by injeting the orientation controlling solution of the polyamide system, the upper and the lower orientation controlling film 4a, 4b, the thickness of which is 800±100Å, are formed on the upper and the lower substrates 2a, 2b on which the

electrodes were formed.

In this case, to form a uniform cell gap, a method of printing after interposing the spacers 6b between the upper and the lower orientation controlling films 4a, 4b and a method of dispersing after putting it in volatile material or pure material are utilized.

And, to contain the liquid crystal 5 and to maintain the uniform space between the upper and the lower substrates 2a, 2b, the sealing resin part 7a, 7b are printed by means of a screen mask formed by etching after coating emulsion of epoxy resin which is mixed after the spacers 6a are put in, the shape of which is shown in FIG. 2 and FIG. 3.

In this case, the printing of conductors 8a, 8b is performed on another substrate on which the sealing resin parts 7a, 7b are not printed, by the same method.

And then, the printed substrates are piled up in turn to be laminated, and disposed in a compressing jig, and compressed to be hardened with being heated in a container such as an oven, and then a unit substrate cell is manufactured by cutting and a liquid crystal 5 is put therein in vacuum ambience, and the liquid crystal injection opening is sealed with an end seal 9 of ultraviolet rays hardening resin, and then the resultant sealed cell is washed, and the upper and the lower polarizing plate 1a, 1b are fixedly attached thereon.

In manufacturing an LCD through the above-described process, in case of compressing to harden the sealing resin part 7a of epoxy resin material after printing the conductors 8a of silver paste (Ag paste) and the sealing resin part 7a for containning

liquid crystal by means of a screen mask as shown in FIGs. 2A and 2B, the forces applied to the sealing resin parts 7a, 7b and to the conductors 8a are different from each other.

In this case, if the sealing resin parts 7a, 7b are heated, it is spread out before it is hardened, and conductors 8a are disposed out of the sealing resin parts, not considering the breadths of which the conductors 8a and the sealing resin parts 7a, 7b are spread out. As a result of this, the force that the sealing resin parts 7a, 7b hold the upper and the lower substrates 2a, 2b and the force compressing the sealing resin parts are mismatched so that the cell gap is not uniform.

Especially, a super twisted nematic (STN) type LCD is required to have a very high uniformity that the cell gap is within a range under 0.1 μm, the following process is utilized in manufacturing a conventional STN type LCD.

That is, after liquid crystal is injected into the cell and air pressure is applied thereon by means of an air tube so that the cell gap may be uniform, an end seal is applied thereon, and then air pressure is made to be decreased for the end seal to be sucked in. And then, it is hardened by means of a UV lamp, and the polarizing plates are attached thereon, thereby a STN type LCD is completed.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a liquid crystal display and the method thereof which has a high uniformity of the cell gap and thus has a good performance.

It is another object of the present invention to provide a

liquid crystal display and the method thereof which has a high uniformity even though it is not processed by a separate equipment in production.

To achieve the above objects, the present invention provides a liquid crystal display comprising:

upper and lower polarizing plates, each having a polarizing axis corresponding to the orientation direction of liquid crystal molecules;

upper and a lower substrates of light transmitting glass material fixedly attached to the lower surface of said upper polarizing plate and the upper surface of said lower polarizing plate, respectively;

upper and lower electrodes which are formed of a transparent electroconductive film of indium tin oxide and fixedly attached to the lower surface of said upper substrate and the upper surface of said lower substrate, respectively, with oxide film layers being interposed between said electrodes and said substrates;

upper and lower transparent insulating orientation controlling films fixedly attached to said upper and lower electrodes, respectively;

a sealing resin part disposed at the outer peripheral surfaces of said upper and lower orientation controlling films to contain a liquid crystal and to include spacers for maintaining the space between the upper and the lower substrates in a predetermined range, the width of at least a portion of said sealing resin part being different from other portions, and said dummy sealing resin parts formed outside said partion; and

conductors disposed between said dummy sealing resin parts outside said sealing resin part to interconnect said upper and lower electrodes.

Preferably, the width of the sealing resin part at which the conductors are formed is narrower than that of the other sealing resin part at which the conductors are not formed.

Further, it is preferred that the shapes of the conductors are oval, and that a deflection part is formed between the sealing resin part at which the conductors are formed and the other sealing resin part at which the conductors are not formed.

Further to achieve the above objects, the present invention provides a method of manufacturing a liquid crystal display, comprising the steps of:

coating photoresist on an upper and a lower substrates of light transmitting glass material to form desired electrode patterns after washing and drying them;

exposing said upper and lower substrates to light through a pattern-formed chrome mask to form an upper and a lower electrodes and washing and drying them;

forming an upper and a lower orientation controlling films on said electrode-formed upper and lower substrates by the injection of an orientation controlling solution;

interposing spacers between said upper and lower orientation controlling films and printing it, and dispersing it in a volatile material or a pure material;

printing conductors for interconnecting said upper and lower electrodes;

printing to form a sealing resin part which includes dummy

sealing resin parts at the conductor-formed part and the bredth of a part of which is different from that of the other part, by means of a screen mask formed by coating and etching an emulsion of an epoxy system resin in which spacers are put and mixed;

piling up and laminating the printed substrates, mounting it on a compressing jig, and heating and compressing it in a container such as an oven to be hardened, and then cutting it to produce a unit substrate cell, and injecting a liquid crystal therein under vacuum atmosphere, and then sealing the liquid crystal injecting opening by means of a sealant of a ultra-violet-ray-hardened resin; and

washing the sealed cell, and fixedly attaching an upper and a lower polarizing plates thereon plates thereon.

BRIEF DESCRIPTION OF THE DRAWINGS

The above objects and other features and advantages of the present invention will become more apparent by describing the preferred embodiments of the present invention with reference to the drawings, in which:

FIG. 1 is a longitudinal cross-sectional view of a conventional liquid crystal display;

FIGs. 2A and 2B are views respectively showing an arrangement of the sealing resin parts and the conductors in a conventional liquid crystal display;

FIG2. 3A and 3B are enlarged views respectively of A part and B part in FIG. 2;

FIG. 4 is a view showing an arrangement of the sealing resin parts and the conductors in a conventional liquid crystal display

more concretely;

FIGs. 5A and 5B are views respectively showing an arrangement of the sealing resin parts and the conductors in a liquid crystal display of the present invention;

FIGs. 6A to 6D are views respectively showing an arrangement of the sealing resin parts and the conductors concretely in the first to the fourth embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIGs. 5A and 5B respectively show arrangements of the sealing resin parts and the conductors of an LCD according to the present invention, and FIGs. 6A to 6D respectively are more detail view showing the arrangements of the sealing resin parts and the conductors of an LCD according to the present invention, in which the breadths of the sealing resin parts 17a, 17a1, 17a2 at predetermined parts are different from those at other parts, a deflection part 19 is formed between the sealing resin part 17a1 and the sealing resin part 17a2 respectively having and not having the conductors 18a and the dummy sealing resin parts 17b, 17b1, 17b2. Especially, the sealing resin part 17a can be formed such that the bredth of the sealing resin part 17a1 is narrower than the bredth of the sealing resin part 17a2, as shown in FIGs. 6A to 6D.

FIG. 6A shows a construction of one embodiment of the present invention, in which the bredth of the sealing resin part 17a1 having the conductors 18a and the dummy sealing resin parts 17b1, 17b2 is about 0.25mm and the bredth of the sealing resin part 17a2 is about 0,38mm, and the shapes of the conductors 18a

are oval.

FIG. 6B shows another embodiment similar to the embodiment of FIG. 6A. In FIG. 6A the horizontal dummy sealing resin parts 17b1 are separated from the vertical dummy sealing resin parts 17b2, while in FIG. 6B they are incorporated to form a dummy sealing resin part 17b of 'T' shape. The bredth of the dummy sealing resin part 17b is about 0.15mm, the horizontal length thereof is about 0.6mm, and the interval between the dummy sealing resin parts 17b is about 0.4mm.

FIGs. 6C and 6D show other embodiments different from those of FIGs. 6A and 6B, in which the dummy sealing resin parts 17b have no horizontal parts and the deflection part 19 is formed in one side (FIG. 6C)or either sides (FIG. 6D) of the sealing resin part 17a1 having the dummy sealing resin part 17b. In this case, it is preferred that the spacers are selected such that the difference of the diameters of the orientation controlling film part and the sealing part is about 0.20~0.25μm.

An LCD constructed as above can have the high uniformity of the cell gap because the bredth of the sealing resin part is not uniform considering the bredth that the sealing resin parts and the conductors are spread out in compressing to harden the sealing resin part. Further, the high uniformity required for an STN type LCD can be achieved without a separate process such as injection of air pressure by means of an air tube, thereby an LCD having good performance can be manufactured. Furthermore, the production of a TN type LCD can be conversed to the production of an STN type LCD without separate producing equipment, and the simultaneous production of the TN type LCD and

the STN type LCD is possible, thereby the cost of equipment can be reduced because the simultaneons production of many kinds and small quantity of LCD is possible.

WHAT IS CLAIMED IS

1. A liquid crystal display comprising:

upper and lower polarizing plates, each having a polarizing axis corresponding to the orientation direction of liquid crystal molecules;

upper and a lower substrates of light transmitting glass material fixedly attached to the lower surface of said upper polarizing plate and the upper surface of said lower polarizing plate, respectively;

upper and lower electrodes which are formed of a transparent electroconductive film of indium tin oxide and fixedly attached to the lower surface of said upper substrate and the upper surface of said lower substrate, respectively, which oxide film layers being interposed between said electrodes and said substrates;

upper and lower transparent insulating orientation controlling films fixedly attached to said upper and lower electrodes, respectively;

a sealing resin part disposed at the outer peripheral surfaces of said upper and lower orientation controlling films to contain a liquid crystal and to include spacers for maintaining the space between the upper and the lower substrates in a predetermined range, the width of at least a portion of said sealing resin part being different from other portions, and said portion having dummy sealing resin parts formed outside said portion; and

conductors disposed between said dummy sealing resin parts outside said sealing resin part to interconnect said upper and

lower electrodes.

2. A liquid crystal display as claimed in claim 1, wherein the width of said part of the sealing resin part in which the dummy sealing resin parts are formed is narrower than that of the other part of the sealing resin part in which the dummy sealing resin parts are not formed.

3. A liquid crystal display as claimed in claim 1, wherein the shapes of said conductors are oval.

4. A liquid crystal display as claimed in claim, wherein said sealing resin part comprises a deflection part between the part in which the dummy sealing resin parts are formed and the part in which the dummy sealing resin parts are not formed.

5. A method of manufacturing a liquid crystal display, comprising the steps of:

coating photoresist on an upper and a lower substrates of light transmitting glass material to form desired electrode patterns after washing and drying them;

exposing said upper and lower substrates to light through a pattern-formed chrome mask to form an upper and a lower electrodes and washing and drying them;

forming an upper and a lower orientation controlling films on said electrode-formed upper and lower substrates by the injection of an orientation controlling solution;

interposing spacers between said upper and lower orientation controlling films and printing it, and dispersing it in a volatile material or a pure material;

printing conductors for interconnecting said upper and lower electrodes;

printing to form a sealing resin part which includes dummy sealing resin parts at the conductor-formed part and the bredth of a part of which is different from that of the other part, by means of a screen mask formed by coating and etching an emulsion of an epoxy system resin in which spacers are put and mixed;

piling up and laminating the printed substrates, mounting it on a compressing jig, and heating and compressing it in a container such as an oven to be hardened, and then cutting it to produce a unit substrate cell, and injecting a liquid crystal therein under vacuum atmosphere, and then sealing the liquid crystal injecting opening by means of a sealant of a ultra-violet-ray-hardened resin; and

washing the sealed cell, and fixedly attaching an upper and a lower polarizing plates thereon.

-14-

Patents Act 1977 Examiner's report to the Comptroller under Section 17 (The Search report)	Application number GB 9326285.5
Relevant Technical Fields (i) UK Cl (Ed.M) G2F (FCD) G5C (CHD, CHE, CHG) (ii) Int Cl (Ed.5) G02F 1/1339, 1/1345	Search Examiner G M PITCHMAN Date of completion of Search 10 MARCH 1994
Databases (see below) (i) UK Patent Office collections of GB, EP, WO and US patent specifications. (ii) ONLINE DATABASES: WPI, CLAIMS	Documents considered relevant following a search in respect of Claims :- 1 TO 5

Categories of documents

X:	Document indicating lack of novelty or of inventive step	P:	Document published on or after the declared priority date but before the filing date of the present application
Y:	Document indicating lack of inventive step if combined with one or more other documents of the same category.	E:	Patent document published on or after, but with priority date earlier than, the filing date of the present application.
A:	Document indicating technological background and/or state of the art.	&:	Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages		Relevant to claim(s)
P A	EP 0556855 A1	(CANON) see abstract	1, 5
P A	EP 0528603 A1	(IBM) see Claim 2	1, 5
A	US 4458987	(SASAKI)	1, 5

Databases:The UK Patent Office database comprises classified collections of GB, EP, WO and US patent specifications as outlined periodically in the Official Journal (Patents). The on-line databases considered for search are also listed periodically in the Official Journal (Patents).